

Novel Catalytic Reactor for CO₂ Reduction via Sabatier Process, Phase I

Completed Technology Project (2010 - 2010)



Project Introduction

Precision Combustion, Inc. (PCI) proposes to develop a novel, efficient, and lightweight catalytic Sabatier CO₂ methanation unit, capable of converting a mixture of CO₂ and H₂ to methane and water with targeted CO₂ conversions of $\geq 90\%$ at high throughputs and at low operating temperatures (≤ 350

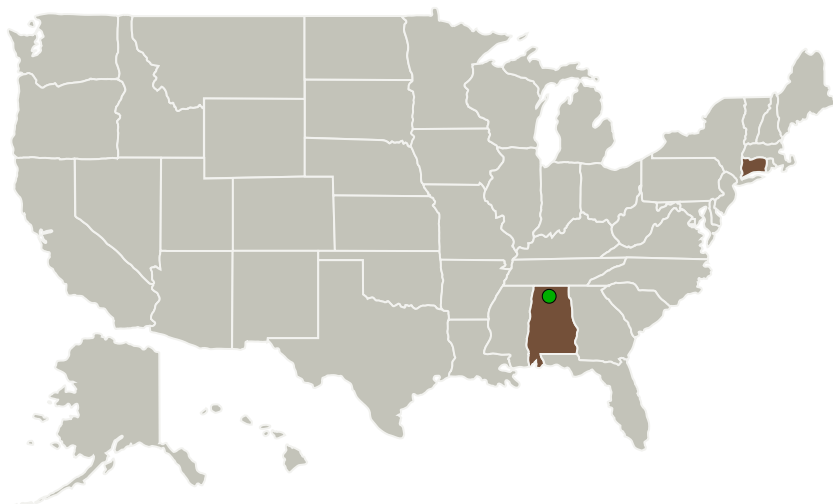
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C). In the spacecraft cabin air revitalization system (ARS), the utilization of CO₂ to produce life support consumables, such as O₂ and H₂O, via Sabatier process as part of the CO₂ Reduction Assembly (CRA) is an important aspect for long-term manned space explorations. The maturation of this technology will significantly reduce the need of re-supply from Earth. Sabatier reaction is highly exothermic and is limited by the thermodynamic equilibrium; therefore, the ability to control and maintain axial reactor temperature and catalyst surface temperature is crucial for obtaining good reactor performance and preventing catalyst deactivation. The proposed program will build on the short contact time kinetic benefits of Microlith

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technology (patented and trademarked by PCI) and PCI's proven catalyst coating development process from prior NASA programs, to demonstrate a proof-of-concept toward delivering a modular, compact, and durable Sabatier CO₂ reduction prototype to NASA.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Precision Combustion, Inc.	Lead Organization	Industry	North Haven, Connecticut
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Connecticut

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Summary: Novel Catalytic Reactor for CO2 Reduction via Sabatier Process, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image(<https://techport.nasa.gov/file/140078>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Precision Combustion, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Christian Junaedi

Co-Investigator:

Christian Junaedi

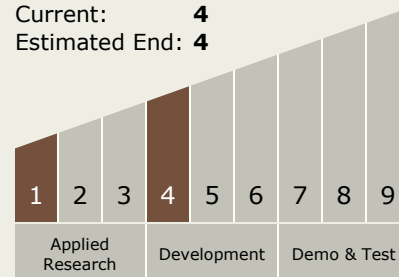
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Technology Maturity (TRL)

Start: **1**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
 - └ TX06.1.1 Atmosphere Revitalization

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System